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Soft Matter Nanotechnology- CIC biomaGUNE

Hybrid Magnetic Stimuli- Responsive Nanostructures for Neurostimulation



Tuesday, 25th March
12.00 p.m.

CIC biomaGUNE - Seminar Room

Magnetic fields have emerged as a powerful tool in biomedical applications, offering a non-invasive, remotely controllable approach for precise spatial and temporal modulation in targeted therapies. Biological tissue is largely transparent to magnetic energy, allowing magnetic fields to pass through without significant absorption or distortion.

Anisotropic magnetic nanoparticles, such as magnetite nanodiscs, possess unique intrinsic properties, including the ability to act both as nanoscale 'heaters' and as 'torquers' by leveraging either hysteretic losses, under kHz frequencies or transitions from vortex to in-plane magnetization under Hz frequencies.

This seminar will explore the design, synthesis, and characterization of hybrid magnetic stimuli-responsive nanostructures, achieved by integrating magnetite nanodiscs with advanced polymeric coatings. These hybrid systems leverage the unique bimodal functionality of MNDs in combination with functional polymeric materials to enable controlled nanoscale heating, torque generation, and targeted delivery mechanisms.

Special emphasis will be placed on their potential for neuronal modulation, leveraging thermo-responsive coatings to facilitate genetic modulation via viral vector transport, and piezoelectric coatings to convert torques into electrical signals for the remote control of mechanosensory neurons.